REMARKS

Claims 1, 3, 5-13 and 15-18 are all the claims pending in the application, prior to the present Amendment.

Applicants have amended claim 1 to incorporate the recitations of claims 3 and 5, and have amended claim 13 to incorporate the recitations of claim 16. Applicants have canceled claims 3, 5 and 16, and have amended the dependencies of claims 6-9 in view of the cancellation of claims 3 and 5. Thus, upon entry of the amendment, claims 1, 6-13, 15, 17 and 18 will be pending.

The Examiner has attached to the Office Action a copy of the PTO/SB/08 A & B (Modified) Forms filed with the Information Disclosure Statements of March 21, 2005, October 5, 2006 and April 27, 2007. The Examiner has initialed and dated these Forms to indicate that he has considered and made of record the documents listed on these Forms.

In a "continuation sheet" of the Office Action Summary, the Examiner states that there are four attachments for the dates of March 21, 2005, October 5, 2006, December 27, 2006 and April 27, 2007. Applicants note, however, that applicants did not file any Information Disclosure Statement on December 27, 2006. The only document that applicants are aware that is of record for the date of December 27, 2006 is the Office Action which the Examiner issued on that date. Applicants request the Examiner to clarify the record on this point.

Applicants further note that the Examiner has attached four separate PTO/SB/08 A & B (Modified) Forms, but two of those forms are duplicates of each other. Applicants request clarification of why duplicate forms were attached.

At page 10 of the Office Action, the Examiner indicates that claims 16-18 contain allowable subject matter and would be allowed if rewritten in independent form. The Examiner sets forth a statement of reasons for the indication of allowable subject matter.

The recitations of claim 16, which recited an outer crucible disposed to surround the growth crucible with a space left therebetween, and a means for continuously feeding a silicon raw material from outside into the space left between the outer crucible and the growth crucible, are stated by the Examiner to not be found in the prior art of Davis et al, Chang et al, Shiomi et al and Vodakov et al.

Applicants note that claim 3, which is a method claim, contained recitations similar to those of claim 16. The Examiner has found the recitations of claim 3 to be rendered obvious by Shigeto et al. In the Examiner's statement of reasons for allowance, the Examiner does not mention the Shigeto et al publication. Shigeto et al do not disclose the means recited in claim 16 and, accordingly, applicants submit that claim 16 is allowable over Shigeto et al. Applicants submit that since claim 16 is allowable, then claim 1, which has been amended to incorporate the subject matter of claim 3, similarly is allowable.

Claims 13 and 15 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 4,866,005 to Davis et al.

Applicants submit that Davis et al do not disclose or render obvious the subject matter of claims 13 and 15 and, accordingly, request withdrawal of this rejection.

Claim 13 is an independent claim directed to an apparatus for producing a silicon carbide single crystal.

In the Amendment Under 37 C.F.R. § 1.111 filed on April 27, 2007, claim 13 was amended to delete the recitations of an outer crucible, a space and feeding means. These recitations were presented in a new claim 16 that depended from claim 13. In the present Office Action, the Examiner has indicated that claim 16 contains allowable subject matter.

Applicants have now amended claim 13 to reinsert the recitations of claim 16 of an outer crucible, a space and feeding means, and to further recite that the silicon raw material is in solid form. Claim 16 has been canceled. In addition, applicants have amended the dependency of claims 17 and 18 in view of the cancellation of claim 16.

In view of the incorporation of the allowable subject matter of claim 16 into claim 13, applicants submit that claim 13, and the claims dependent thereon, namely, claims 15, 17 and 18, are allowable.

The Examiner states that Figure 1 of Davis et al discloses an outer crucible 14 disposed to surround a growth crucible 20 with a space left therebetween. The Examiner further states that Davis et al disclose, at column 6, lines 33-35 and column 11, lines 62-68, that the apparatus includes metered feeding.

Davis et al disclose, at column 6, lines 33-35, a supply of source powder from the outside of a crucible. However, the source powder supplied by Davis et al is not Si powder, but SiC powder. The SiC source powder in Davis et al is heated until the sublimation of SiC, to afford a temperature gradient between the surface of a seed crystal and the SiC source powder and retain the temperature of the seed crystal surface to less than the sublimation temperature of SiC, thereby growing SiC crystals on the seed crystal. See column 8, line 59 to column 9, line 1.

In addition, in Figure 1 of Davis et al, the SiC source powder is disposed in the annular chamber 16, as described at column 6, lines 40-42, and there is no suggestion therein concerning the supply of a silicon raw material in solid form, that is, solid Si, into the annular chamber 16.

With respect to the Examiner's reference to column 11, lines 62-68, this refers to an embodiment shown in Figure 5 of Davis et al where gas feeds of silane and ethylene are present to introduce these gases into the system to form silicon carbide vapors in the growth crucible. Applicants submit that this disclosure does not satisfy any of the recitations of amended claim 13 or claim 15. Applicants point out that the raw material supplied in claim 13 from the outside of the crucible is a silicon raw material in solid form, that is, solid Si, and is not a mixed gas of Si and C supplied as reaction gas for forming SiC.

In view of the above, applicants submit that Davis et al do not disclose or render obvious the subject matter of claims 13 and 15 and, accordingly, request withdrawal of this rejection.

Claim 1 has been rejected under 35 U.S.C. § 103(a) as obvious over Davis et al in view of Chang et al, and further in view of Shiomi et al.

Applicants submit that Davis et al, Chang et al and Shiomi et al do not disclose or render obvious the subject matter of claim 1 and, accordingly, request withdrawal of this rejection.

Claim 1 is an independent claim directed to a method for producing a silicon carbide single crystal. Applicants have amended claim 1 to include the subject mater of claims 3 and 5, which have been canceled. In addition, applicants have amended claim 1 to make it clearer by replacing at the end of claim 1, the word "that" with the phrase "with vapor pressure of silicon gas." This wording more closely follows the original wording of claim 2, which provided

support for the previous amendment to the last two lines of claim 1. Applicants have made a similar amendment to claim 13.

The Examiner recognizes that Davis et al do not disclose or suggest that the silicon carbide singe crystal is grown with an atmosphere gas that surrounds the growth crucible containing a silicon gas. The Examiner relies on Chang et al for such a disclosure. The Examiner particularly refers to column 3, lines 19-32 and column 11, lines 47-45 of Chang et al.

The Examiner argues that it would have been obvious to modify the method of Davis et al by including an atmosphere gas surrounding the growth crucible to contain a silicon gas in order to reduce the amount of crystalline defects in the silicon carbide single crystal as suggested by Chang et al.

Chang et al is directed to a method to produce single crystals having a high state of perfection, that is, single crystals with less defects. Chang et al disclose, at column 2, that in their method, single crystals are grown on the surface of a material other than the solid material comprising such single crystals. In contrast, Davis et al is directed to a method in which single crystals are grown on the surface of a material that comprises the single crystals. Accordingly, applicants submit that one of ordinary skill in the art would not be led to combining the teachings of Davis et al with those of Chang et al.

Further, with respect to the disclosure at column 3, lines 19-32 of Chang et al, as applicants argued at page 14 of the Amendment Under 37 C.F.R. § 1.111 filed on April 27, 2007, in this embodiment of Chang et al, there is only a charge of raw material that is outside of the growth cylinder and which forms a gas which permeates the walls of the cylinder. In this

embodiment of Chang et al, there is not a separate charge of raw material inside the cylinder and a surrounding gas outside the cylinder.

In addition, as applicants argued at page 14 of the Amendment of April 27, 2007, Chang et al further describe at column 3, lines 20-27, that the periphery of the hollow cylinder 14 shown in Figure 1 should be packed with the raw material massed as densely as possible. On the other hand, in the present invention, it is necessary to appropriately determine the pressure of the atmosphere gas surrounding the growth crystal in order to optimize the growth rate and crystallinity of the silicon carbide single crystal as disclosed at page 22, lines 8-12 of the specification. Chang et al do not disclose or suggest this concept.

The Examiner recognizes that even if Davis et al were modified to employ a surrounding gas atmosphere, Davis et al still does not teach that the vapor pressure of the silicon gas that surrounds the growth crucible should be continuously maintained to be higher than that of the silicon gas in the gas sublimated from the silicon carbide raw material in the growth crucible, and does not teach that the vapor pressure of the silicon gas in the growth crucible should be maintained substantially equal to or higher than the equilibrium vapor pressure of silicon gas in the gas sublimated from the silicon carbide raw material.

The Examiner relies on Shiomi et al for such a suggestion.

The Examiner relies particularly on the disclosure of Shiomi et al at column 2, lines 33-37, Figure 5, and the disclosure at column 3, lines 13-15. The Examiner states that Shiomi et al disclose that the vapor pressure of silicon is higher than that of SiC_2 or Si_2C occurring during the generation of SiC and that the partial pressure of silicon can be adjusted.

The Examiner argues that it would have been obvious to modify Davis et al by adjusting the silicon gas vapor pressure that surrounds the growth crucible to continuously be maintained to be higher than that of the silicon gas in the gas sublimated from the silicon carbide raw material in the growth crucible in order to enhance the silicon carbide forming speed, as suggested by Shiomi et al.

The Shiomi et al patent was discussed at pages 15-17 of the Amendment Under 37 C.F.R. § 1.111 filed on April 27, 2007. The Examiner does not discuss or comment on the arguments that applicants submitted with respect to Shiomi et al. Applicants continue to rely on those arguments. (In those arguments, applicants referred to column 5, lines 19-23 of Shiomi et al, but the reference should have been to column 3, lines 19-23 of Shiomi et al.)

The method disclosed by Shiomi et al forms a SiC single crystal by the steps of disposing an Si raw material and a C raw material independently, allowing a gas component generated from the Si raw material to react with the C raw material to generate an SiC gas and causing the SiC gas to reach an SiC seed crystal. See column 3, lines 11-18.

However, the Shiomi et al method inevitably entails a fundamental problem that the gas components of Si gas and C raw material are subject to easy variation, and as a result, there is variation in the composition of the sublimate gas with the progress of the sublimation of the silicon carbide. See page 4, lines 20-26, of the present specification. And, since the vapor pressure of C is lower than that of Si, the growth rate of SiC single crystal is low. See page 5, lines 9-12, of the present specification.

Still further, applicants point out that in the present invention of claim 1, there are two vapor pressures that are to be maintained. One is the vapor pressure of the silicon gas that

surrounds the growth crucible. The other is the vapor pressure of the silicon gas in the growth crucible. The Examiner has asserted that it would have been obvious to adjust the silicon gas vapor pressure of the silicon gas that surrounds the growth crucible. The Examiner, however, has not explained why it would have been obvious to make such an adjustment. Shiomi et al do not contain any disclosure relating to the vapor pressure outside the growth crucible. The Shiomi et al disclosure relates to the vapor pressure inside the growth crucible. Accordingly, one of ordinary skill in the art would not have any reason to adjust vapor pressure outside the growth crucible.

Further, the Examiner has not made any comment with respect to the vapor pressure of the silicon gas in the growth crucible.

In view of the above, applicants submit that Davis et al, Chang et al and Shiomi et al do not disclose or render obvious the subject matter of claim 1 and, accordingly, request withdrawal of this rejection.

Claims 3 and 5-10 have been rejected under 35 U.S.C. § 103(a) as obvious over Davis et al in view of Chang et al and Shiomi et al, and further in view of Shigeto et al '877.

As noted above, claims 3 and 5 have been canceled, and their subject matter has been incorporated into claim 1.

Applicants submit that Davis et al, Chang et al, Shiomi et al and Shigeto et al do not disclose or render obvious the subject matter of amended claim 1 and the claims dependent thereon and, accordingly, request withdrawal of this rejection.

In this rejection, the Examiner states that the combined teachings of Davis et al, Chang et al and Shiomi et al do not teach continuously feeding a silicon raw material from outside into the

space, and do not teach the silicon raw material size feed rate in the amount of gas pressure surrounding the growth crucible of SiC.

The Examiner relies on Shigeto et al to supply such teachings.

In particular, the Examiner relies on the abstract and paragraph [0018] of Shigeto et al '877 for disclosing continuously feeding a silicon raw material from outside into the space.

In the Amendment filed on April 27, 2007, applicants set forth arguments on Shigeto at page 18. Applicants continue to rely on those arguments. Applicants point out that the Examiner has not replied to the specific arguments that applicants set forth at page 18.

In addition, in Fig. 1 of Shigeto et al, the reaction between the C raw material 3 disposed on the lower portion of the reaction crucible 1 and molten or gasified Si generates a gas composed preponderantly of SiC, and unreacted SiC gas is allowed to pass through an auxiliary C raw material 25, thereby providing a configuration in which the composition of the reaction gas is more efficiently stabilized.

Thus, the invention of Shigeto et al forms SiC single crystals utilizing the same principle as in Shiomi et al.

Therefore, the inventions of Shigeto et al and Shiomi et al have the same problems in common with each other.

In view of the above, applicants submit that Davis et al, Chang et al, Shiomi et al and Shigeto et al do not disclose or render obvious the subject matter of claims 1 and 5 to 10 and, accordingly, request withdrawal of this rejection.

Claims 11 and 12 have been rejected under 35 U.S.C. § 103(a) as obvious over Davis et al, Chang et al, Shiomi et al, Shigeto et al and Vodakov et al.

Applicants submit that Davis et al, Chang et al, Shiomi et al, Shigeto et al and Vodakov et al do not disclose or render obvious the subject matter of claims 11 and 12 and, accordingly, request withdrawal of this rejection.

The Examiner relies on Vodakov et al for a teaching of a growth rate of a silicon carbide single crystal of 1 mm/hour or more, as set forth at column 8, lines 42-46.

Claims 11 and 12 are dependent claims that depend either directly or indirectly from claim 1. Vodakov et al do not supply the deficiencies of Davis et al, Chang et al and Shigeto et al '877 with respect to claim 1.

In view of the above, applicants submit that Davis et al, Chang et al, Shiomi et al, Shigeto et al and Vodakov et al do not disclose or render obvious the subject matter of claims 11 and 12 and, accordingly, request withdrawal of this rejection.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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